YANGON UNIVERSITY OF ECONOMICS

POSTGRADUATE DIPLOMA IN RESEARCH STUDIES

DETERMINANTS OF LIFE EXPECTANCY IN DEVELOPING COUNTRIES: CROSS-COUNTRY ANALYSIS

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This research paper is submitted as partial fulfilment of the requirements for the Postgraduate Diploma in Research Studies.

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ACCEPTANCE

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ABSTRACT

Life expectancy is a crucial synthetic indicator for assessing the economic and social development of a country or region. Its interpretation provides key information on the level of development of a country's welfare state. This study was conducted to determine the factors influencing life expectancy in developing nations, focusing on gross domestic product (GDP) per capita, basic sanitation services, fertility rate, and urban population. Panel data from 119 developing countries were obtained from the World Development Indicators (WDI) for the years 2008 and 2018. Multiple regression models with ordinary least squares (OLS) and first difference estimation methods were applied. The results showed that improvements in basic sanitation services, increases in GDP per capita and urbanization, and reductions in fertility rates significantly contribute to improving life expectancy in developing countries.

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LIST OF ABBREVIATIONS

ARIMA	Autoregressive Integrated Moving Average
CO_2	Carbon Dioxide
GDP	Gross Domestic Product
HALE	Healthy Life Expectancy
LE	Life Expectancy
LEAB	Life Expectancy at Birth
SAARC	South Asian Association for Regional Cooperation countries
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
WDI	World Development Indicators
WHO	World Health Organization

CHAPTER I

INTRODUCTION

Although health is a multi-dimensional concept, life expectancy is one of the most widely used indicators of population health (Sharma, 2018). Understanding life expectancy provides a comprehensive assessment of the typical lifespan within a specific location, akin to a collective health assessment; despite global healthcare advancements, disparities persist, particularly evident in poorer countries, emphasizing the importance of identifying factors contributing to divergent lifespans to facilitate the formulation of effective policies for community well-being and development. Therefore, it is also an important indicator to evaluate the economic and social progress of a nation or a specific area (Bilas et al., 2014).

1.1 Rationale of the Study

Life expectancy at birth means how long, on average, a person can expect to live from the time they are born. In developed countries, people are living much longer now compared to the past two hundred years (Roffia et al., 2023). Despite global advancements in healthcare technology and services, significant differences in life expectancy persist, particularly noticeable in developing countries. Understanding the factors that affect life expectancy is crucial for creating specific policies to improve public health and support long-term development.

Among the many things that impact how long people live, a country's GDP per capita is especially important. It shows how wealthy a country is and how much it can spend on healthcare and social support. Higher GDP per capita is often associated with better access to healthcare services, improved sanitation, and enhanced living standards, all of which contribute to longer life expectancy. Understanding the role of GDP per capita is crucial for comprehensively assessing the socio-economic landscape impacting life expectancy and guiding policy interventions effectively (Miladinov, 2020).

Having access to clean sanitation is really important for keeping people healthy. When sanitation is poor, it does not just make people sick directly, like spreading diseases through dirty water. It also makes it harder to improve overall public health. Countries with higher levels of sanitation coverage typically experience lower rates of

infant mortality, reduced incidence of infectious diseases, and consequently, higher life expectancy (Ummalla et al., 2022).

Additionally, the number of births per woman has a large impact on population changes and, therefore, how long people live. In the past, when there were a lot of births, it often meant people did not live as long because it put a lot of pressure on healthcare and resources. However, the relationship between fertility and life expectancy is complex, influenced by socio-cultural factors, government policies, and access to family planning services. Understanding the nuances of this relationship is essential for predicting future population trends and formulating effective public health strategies. A lower fertility rate may lead to improvements in maternal and child health outcomes, contributing to longer life expectancies and healthier populations (Miles, 2023).

Lastly, the pace of urbanization is increasingly recognized as a critical determinant of population health outcomes. Urban areas often offer better access to healthcare facilities, educational opportunities, and employment prospects, leading to improved health outcomes and higher life expectancy compared to rural areas. However, rapid urbanization can also strain infrastructure and exacerbate socio-economic disparities, potentially impacting health outcomes in complex ways. Understanding the dynamics of urbanization is crucial for developing policies that promote equitable access to healthcare and address the challenges associated with urban growth to ensure sustainable improvements in population health and life expectancy (Zhang et al., 2023).

While considerable progress has been made in extending life expectancy globally, significant disparities persist, particularly among developing countries. Understanding the determinants of life expectancy in these nations is imperative for policymakers to formulate targeted interventions aimed at improving public health outcomes.

This research explores the determinants of life expectancy in developing nations, focusing on gross domestic product (GDP) per capita, sanitation access, fertility rates, and urbanization levels as key variables through a comprehensive cross-country analysis. Life expectancy is the dependent variable, while GDP per capita, sanitation coverage, fertility rates, and urban population percentage serve as independent variables. Understanding how these factors collectively influence

longevity can inform strategies to improve overall health outcomes in developing countries.

1.2 Objectives of the Study

The primary objective of this study is to investigate the determinants of life expectancy in 119 developing countries using panel data for the years 2008 and 2018. Specifically, the study aims:

(i) To describe the life expectancy at birth in developing countries.

(ii) To identify the determinants of demographic and socio-economic factors on the life expectancy at birth.

1.3 Method of Study

To achieve the objectives outlined above, this study employs multiple regression models using ordinary least squares (OLS) and first difference estimation methods. In this context, the dependent variable is life expectancy at birth, while the independent variables include GDP per capita, the percentage of the population using at least basic sanitation services, the fertility rate, and the percentage of the population living in urban areas. OLS and first difference estimation methods provide a robust framework for analyzing the relationship between life expectancy and these socio-economic and demographic factors. By applying these econometric techniques, we can rigorously examine how changes in GDP, sanitation access, fertility rates, and urbanization independently and collectively influence life expectancy in developing countries. This approach allows us to capture the complex interactions and provide a comprehensive understanding of the determinants of life expectancy.

1.4 Scope and Limitation of the Study

The scope of this study is limited to 119 developing countries, as classified by the World Bank, in 2008 and 2018. The analysis focuses on the relationship between life expectancy and key socio-economic indicators, namely GDP per capita, access to sanitation services, fertility rate, and urbanization. While these factors provide valuable insights into the determinants of life expectancy, it is important to acknowledge that other variables, such as healthcare infrastructure, education, and environmental factors, may also play a significant role but are beyond the scope of this study. Additionally,

limitations inherent to the data, such as measurement errors and missing values, may impact the robustness of the findings.

1.5 Organization of the Study

This study consists of five chapters. Chapter II provides a comprehensive literature review of the existing literature on the determinants of life expectancy, highlighting relevant theories and empirical evidence. Chapter III describes the data sources and research methodology employed in the analysis, including a detailed explanation of the regression models used. Chapter IV presents the empirical results, including the main findings from the regression analysis and their implications. Finally, Chapter V offers concluding remarks, policy recommendations, and avenues for future research.

CHAPTER II

LITERATURE REVIEW

This chapter provides a theoretical overview and review related studies on life expectancy at birth, GDP per capita, the percentage of the population using basic sanitation services, fertility rate, and the urban population as a percentage of the total population. Additionally, the conceptual framework of the study is described.

2.1 Theoretical Overview

2.1.1 Life Expectancy at Birth

Life expectancy at birth represents the average number of years a person can expect to live from birth, assuming constant age-specific mortality rates. It stands as one of the most critical indicators of a country's well-being. Life expectancy transcends mere statistics; it serves as a lens through which to evaluate the impact of governmental policies, societal behaviors, and cultural norms within a specific context or nation. Moreover, life expectancy exerts influence over various social and economic factors, including fertility rates, consumer spending habits, investment in human capital, pension expenditures, public finances, and economic growth (Roffia et al., 2023).

Life expectancy at birth signifies the average age at which a person is expected to pass away. Widely utilized as a measure of population health, life expectancy serves as a common yardstick for comparing different populations. Moreover, it holds significant value in public policy planning, particularly as a gauge of future population aging trends. The level of life expectancy within a country carries profound implications. It influences fertility rates, economic growth trajectories, human capital investment, intergenerational transfers, and the dynamics of pension benefit claims. Hence, it becomes imperative to identify the factors that impact life expectancy (Pathirathne & Sooriyarachchi, 2019).

2.1.2 GDP per Capita

Gross Domestic Product (GDP) stands as a fundamental macroeconomic indicator used to gauge a country's overall wealth. It can be calculated through three primary methods: income, expenditure, and value-added approaches. Given its

significance, many researchers incorporate GDP into their studies, recognizing it as a pivotal measure for assessing a country's economic condition. Effective prediction of economic growth necessitates a thorough understanding of the prevailing dynamics, where the GDP methodology proves indispensable. One straightforward approach involves scrutinizing the variance between actual and projected figures. Economic growth serves as a barometer of a nation's prosperity, with GDP per capita emerging as a key metric. This measure holds considerable importance within the economic landscape, offering insights into the cumulative economic performance of a country (Arrafi Juliannisa & Artino, 2022).

The crucial role of human capital, particularly health, as a driving force behind economic growth. Health should be regarded as a criterion for economic performance, playing a pivotal role in fostering sustainable development. Through their research, they uncovered insights into the interplay between various factors at the country level. Their analysis revealed that life expectancy significantly influenced health expenditures, indicating a positive impact across countries. Additionally, real GDP per capita demonstrated a moderate positive correlation with health expenditures across most of the countries studied. However, the environmental factor, as represented by greenhouse gas emissions, exhibited either a low positive or negative impact on health expenditures, affecting only a limited number of countries (Bayar et al., 2021).

The relationship between GDP per capita and life expectancy at birth is well-documented in economic literature. Higher GDP per capita generally correlates with improved life expectancy, as increased national income allows for better healthcare infrastructure, higher quality medical services, and greater access to essential resources such as nutritious food, clean water, and sanitation. This economic prosperity enables governments to invest more in public health initiatives, leading to significant reductions in mortality rates and improvements in overall population health. Conversely, countries with lower GDP per capita often struggle with inadequate healthcare systems, limited access to essential services, and higher rates of poverty, all of which can negatively impact life expectancy (Cutler et al., 2006).

2.1.3 Percentage of the Population Using Basic Sanitation Services

Access to sanitation services, which guarantee privacy, dignity, safety, and affordability, is a fundamental human right. Sanitation, being a public good, yields widespread benefits by enhancing health and fostering economic and social development across society. Inadequate sanitation poses significant health risks, disproportionately impacting vulnerable populations, especially children, who are more susceptible to illnesses such as diarrhoea, worm infections, and stunted growth. However, the repercussions extend beyond health, affecting the entire community through environmental pollution. It is crucial to acknowledge that poor sanitation disproportionately burdens marginalized groups, including women and individuals with disabilities. Moreover, sanitation workers, often marginalized and stigmatized, face unacceptable health hazards and indignities in environments lacking proper regulation and hygiene standards (UNICEF and WHO, 2020).

Hygienic sanitation facilities serve as a key metric for gauging progress in combating poverty, disease, and mortality, as recognized by many international organizations. Access to proper sanitation is rightfully deemed a human right, not a privilege, for every individual. Sanitation encompasses the provision of facilities and services for the safe disposal of human waste, including urine and feces. Inadequate sanitation remains a significant global health challenge, contributing to the spread of diseases. However, improving sanitation infrastructure has been shown to yield substantial health benefits. Enhanced sanitation not only directly mitigates disease transmission but also indirectly alleviates the adverse health effects of related conditions. For instance, improved sanitation reduces the incidence of diarrheal diseases and worm infections in children, consequently lowering their susceptibility to malnutrition and secondary infections like pneumonia, measles, and malaria. Monitoring the percentage of the population utilizing at least basic sanitation services provides insight into sanitation coverage. Basic sanitation encompasses improved facilities that are not shared with other households, including flush or pour-flush toilets connected to piped sewer systems, septic tanks, or pit latrines, as well as composting toilets (WHO, 2024).

The percentage of the population using basic sanitation services is closely linked to life expectancy at birth, as access to adequate sanitation is a critical determinant of public health. Improved sanitation facilities help prevent the spread of

infectious diseases such as cholera, typhoid, and diarrheal illnesses, which are major causes of morbidity and mortality, particularly in developing countries. By reducing the prevalence of these diseases, communities experience lower child mortality rates and overall improvements in health outcomes. This leads to higher life expectancy as fewer individuals, especially children, succumb to preventable illnesses. Furthermore, access to basic sanitation services contributes to better overall hygiene and reduces environmental contamination, which in turn supports healthier living conditions. This comprehensive impact on public health emphasizes the importance of investing in sanitation infrastructure to enhance life expectancy (Bartram & Cairncross, 2010).

2.1.4 Fertility Rate

Fertility is measured through indicators such as crude birth rate per 1000 living individuals, and total fertility rate (Summoogum & Fah, 2016). Fertility rates have decreased significantly in most industrialized countries. Although the exact causes remain largely unknown, several factors are believed to influence declining fertility rates. These factors include the age at which individuals start a family, their dietary habits, smoking and alcohol consumption, weight status, and level of physical activity. Prolonged time to pregnancy has been associated with a wide array of health conditions, particularly among women. These conditions include nutritional and metabolic disorders, as well as respiratory ailments. Additionally, prolonged time to pregnancy has been linked to increased mortality rates from pneumonia, other respiratory diseases, and various digestive, urinary, genital, and endocrine disorders in women (Kuningas et al., 2011).

The total fertility rate serves as a pivotal determinant of both the size and composition of a population. It represents the average number of children a woman would bear throughout her reproductive years, based on the age-specific fertility rates of a given year. Given its critical role in shaping population growth rates, numerous studies conducted across different countries or regions have sought to identify the various factors influencing total fertility rates (Cheng et al., 2022).

The relationship between fertility rate and life expectancy at birth is complex and multifaceted. Generally, lower fertility rates are associated with higher life expectancy at birth, particularly in developed countries. This relationship can be

attributed to several factors. Firstly, lower fertility rates often lead to smaller family sizes, allowing for more resources to be allocated per child. This can result in better nutrition, healthcare, and educational opportunities, all of which contribute to improved health outcomes and increased life expectancy. Additionally, countries with lower fertility rates tend to have more advanced healthcare systems and social services, which further enhance life expectancy. Conversely, higher fertility rates, commonly seen in developing countries, can strain limited resources, resulting in inadequate healthcare, higher infant and child mortality rates, and overall lower life expectancy. Furthermore, high fertility rates often correlate with lower women's health standards, as frequent pregnancies and births can lead to health complications for mothers, impacting their longevity. Thus, understanding and managing fertility rates is crucial for public health strategies aimed at improving life expectancy (Low et al., 2013).

2.1.5 Urban Population as a Percentage of the Total Population

Urbanization entails the transition of rural populations to urban areas and is often regarded as a metric of social and economic progress. According to United Nations projections, the global urban population is expected to reach 6.252 billion by 2050, with an urbanization rate of 67.2%. However, rapid urbanization has led to the emergence of what is often termed as 'urban diseases,' encompassing a myriad of social and environmental issues. These include haphazard urban development, population concentration, disproportionate focus on economic growth at the expense of environmental conservation, severe traffic congestion, energy resource depletion, and ecological degradation (Zhang et al., 2023).

Cities serve as vital hubs for technological advancement and economic prosperity in many nations, playing diverse roles within societies. However, the concentration of large populations in urban areas often exacerbates challenges, particularly for impoverished communities. Many rural migrants relocating to urban slums bring their families along with domesticated animals, including pets and livestock. This influx contributes to the spread of communicable diseases and the potential establishment of urban transmission cycles. Additionally, a significant portion of the urban poor reside in unregulated slums characterized by congested, overcrowded, and unsanitary conditions. These areas are often situated near open sewers and face geographical risks such as landslides, flooding, and industrial hazards. These conditions

foster the spread of both communicable and non-communicable diseases, as well as pollution, malnutrition, and road traffic accidents. As urbanization trends persist, these challenges escalate and acquire a global dimension, impacting larger segments of the world's population (Kuddus et al., 2020).

The relationship between the urban population as a percentage of the total population and life expectancy at birth is multifaceted. Urban areas typically provide better access to healthcare services, education, and economic opportunities, which can contribute to higher life expectancy. Cities often have advanced medical facilities, a higher concentration of healthcare professionals, and improved infrastructure, enhancing overall health and longevity. However, rapid and unplanned urbanization can introduce significant public health challenges, such as overcrowded living conditions, pollution, and inadequate infrastructure, which can negatively impact life expectancy. The stress of urban living and socioeconomic disparities can exacerbate health inequities, particularly for marginalized groups. Thus, while urbanization has the potential to improve life expectancy through better access to resources and services, it also requires effective planning and policies to mitigate health risks and ensure equitable outcomes for all urban residents (Vlahov, 2002).

2.2 Review of Related Studies

Cao et al. (2020) engaged in a comparative, correlational analysis, and projection of global and regional life expectancy, healthy life expectancy, and their gap for the years 1995 to 2025. The study utilized data from 195 countries/regions on life expectancy (LE), healthy life expectancy (HALE), and influencing factors spanning from 1995 to 2017. The researchers employed multiple linear regression analysis to examine the relationships among LE, HALE, GAP, and associated factors, and utilized the Autoregressive Integrated Moving Average (ARIMA) model to project trends from 2017 to 2025. During the period of 1995 to 2017, LE, HALE, and their gap in the 195 countries/regions worldwide exhibited overall increasing trends. The global average LE increased from 66.20 to 72.98 years, HALE from 57.59 to 63.25 years, and GAP from 8.62 to 9.72 years. LE and HALE were generally higher in North America, Europe, and Australia, while Africa had the lowest rates. Females' LE, HALE, and GAP were all higher than males', but females' growth rates of LE and HALE were lower. Various factors were considered in the projection of LE, HALE, and GAP, respectively. The

prediction results indicated that approximately 18% of the 195 countries/regions might achieve improved LE and HALE and lower GAP (Cao et al., 2020).

Chen et al. (2021) executed a comparative study to investigate the effects of economic development and environmental factors on life expectancy. Utilizing data spanning from 2004 to 2016, the study analyzed indicators from both developed and developing countries. Drawing from a dataset comprising economic and environmental metrics from 20 countries, the study examined the influencing mechanisms of various indicators on life expectancy in both categories of nations. In developed countries, GDP per capita and the percentage of forest area to land area exhibited a positive impact on life expectancy, whereas they had a negative impact in developing countries. Conversely, total public expenditure on education as a percentage of GDP and fertilizer consumption displayed a negative impact on life expectancy in developed countries but had a positive impact in developing countries. Additionally, the urbanization rate emerged as a significant factor positively influencing life expectancy in both developed and developing countries (Chen et al., 2021).

Jafrin et al. (2021) carried out a panel data estimation to analyze the determinants of life expectancy in selected South Asian Association for Regional Cooperation (SAARC) countries. The study utilized panel data estimation methods to examine the economic, social, demographic, environmental, and technological factors influencing life expectancy in five SAARC countries: Bangladesh, India, Pakistan, Nepal, and Sri Lanka. Secondary data from 2000 to 2016 obtained from the World Bank and UNDP databases were utilized. The results indicate that the mean years of schooling and access to sanitation services are significant positive predictors of life expectancy at birth (LEAB). Conversely, the total fertility rate, urban population, and CO_2 emissions were found to have negative effects on life expectancy. Interestingly, the impact of health expenditure on life expectancy was significant but negative, contrary to conventional expectations. Other independent variables such as GDP, gross capital formation, internet usage, and mobile cellular subscriptions were found to be insignificant predictors of LEAB (Jafrin et al., 2021).

Rahman et al. (2022) reported a study to identify the determinants of life expectancy in the world's most polluted countries, with a particular emphasis on environmental degradation. Using annual data from the World Bank and British

Petroleum spanning 18 years (2000–2017), the study explored the relationship between environmental factors and life expectancy. The findings underscored the significant threat posed by environmental degradation to life expectancy in these countries. However, the study also revealed that health expenditure, access to clean water, and improved sanitation positively influenced life expectancy in the sampled countries. Causality tests conducted as part of the study indicated a one-way causal relationship from carbon emissions to life expectancy. Additionally, bidirectional causal relationships were observed between access to drinking water and life expectancy, as well as between improved sanitation and life expectancy (Rahman et al., 2022).

Nguyen (2022) undertook a study examining the factors affecting life expectancy in Vietnam, Laos, and Cambodia, with a focus on demographics, socioeconomics, and healthcare determinants among others. The research aimed to explore the relationship between these factors and life expectancy. The findings revealed notable trends over the study period. Average life expectancy increased by approximately 1.6 times, while the population aged 65 and older grew by about 59 times. Moreover, GDP growth transitioned from negative to positive, and the industrial sector experienced a remarkable increase of approximately 1000 times. The study's results indicated a positive relationship between life expectancy and demographic factors, as well as healthcare resources. However, the impact of socioeconomic factors on life expectancy was found to be relatively weak (Nguyen, 2022).

Mimi et al. (2024) performed an empirical study to assess the influence of economic, health, environmental, and demographic factors on life expectancy in 36 high-income and 65 middle-income nations spanning the period from 2000 to 2019. The study identified several factors that significantly contribute to changes in life expectancy. In high-income countries, key factors include GDP per capita, population growth, financial development, food production, and fertility rates. However, despite their economic prosperity, high-income countries often face challenges such as rising mortality rates and carbon dioxide emissions, leading to shorter life expectancies. Conversely, in middle-income nations, factors impacting life expectancy encompass rising food production, health expenditures, fertility rates, and economic hardship. Despite these challenges, improvements in life expectancy in middle-income countries are observed, driven by factors such as increasing GDP per capita, financial

development, reduction in earnings inequality between rural and urban areas, and population growth (Mimi et al., 2024).

2.3 Conceptual Framework of the Study

The conceptual framework of the study aims to investigate the determinants of life expectancy at birth using panel data for the years 2008 and 2018 across 119 developing countries. The framework posits that life expectancy, the dependent variable, is influenced by four key independent variables: GDP per capita (constant 2015 US$), the percentage of the population using at least basic sanitation services, the fertility rate, and the percentage of the population living in urban areas (Figure 2.1).

Higher GDP per capita is expected to improve life expectancy by providing better economic resources, while increased access to basic sanitation reduces health risks and diseases, thereby enhancing longevity. Lower fertility rates are associated with better health and education investments per capita, positively impacting life expectancy. Additionally, a higher urban population is presumed to have better access to healthcare and infrastructure, further contributing to increased life expectancy. By employing multiple regression models with ordinary least squares (OLS) and first difference estimation methods, the study seeks to quantify these influences and provide insights for policy interventions to enhance public health outcomes.

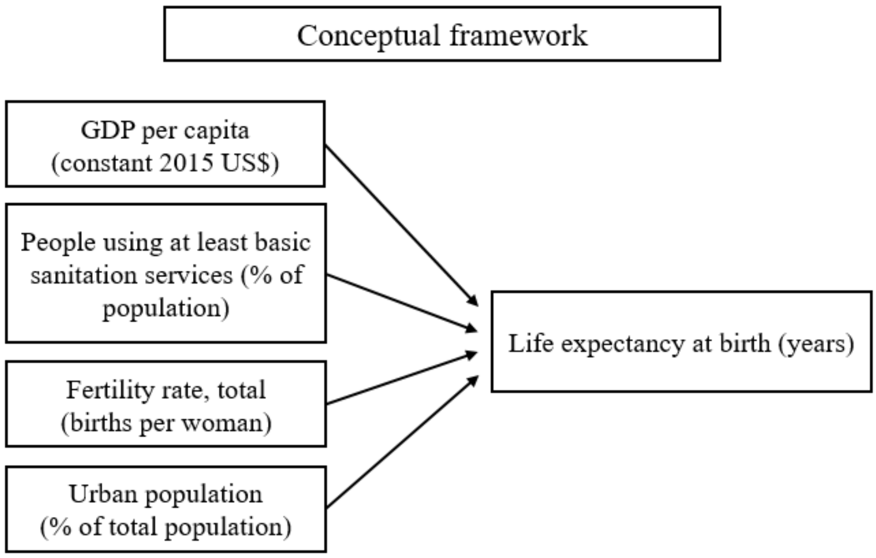

Figure 2.1 Conceptual framework to investigate the determinants of life expectancy at birth

CHAPTER III

RESEARCH METHODOLOGY

This study aims to investigate the determinants of life expectancy in developing countries through a cross-country analysis for the years 2008 and 2018. The methodology employed in this research involves the utilization of quantitative techniques, specifically multiple regression and first difference regression models.

3.1 Data Source

The data source for this study is the World Development Indicators (WDI) provided by the World Bank. The WDI database offers comprehensive and reliable data on various socio-economic indicators for a wide range of countries. Specifically, this study focuses on 119 developing countries for the years 2008 and 2018, encompassing diverse regions and levels of economic development.

3.2 Variables

The dependent variable in this analysis is the life expectancy at birth (*lfe*), measured in total years. Life expectancy serves as a crucial indicator of overall population health and well-being.

The independent variables considered in the analysis are as follows:

GDP per capita (*gdpc*): Measured in constant 2015 US dollars, GDP per capita serves as a proxy for the economic development level of a country. Higher GDP per capita is often associated with better access to healthcare, infrastructure, and resources, which can positively impact life expectancy.

Basic Sanitation (*sani*): Represented as the percentage of the population using at least basic sanitation services, this variable reflects the availability of essential sanitation facilities and infrastructure. Access to sanitation services is integral to public health and can influence life expectancy by reducing the prevalence of waterborne diseases and improving overall hygiene standards.

Fertility Rate (*fert*): The total fertility rate, measured as the number of births per woman, is indicative of demographic trends within a population. Lower fertility rates are typically associated with higher levels of education, increased access to family planning services, and greater gender equality, factors that may positively impact life expectancy through various pathways.

Urban Population (*urban*): Expressed as the percentage of the total population residing in urban areas, this variable captures the degree of urbanization within a country. Urbanization is often accompanied by improved access to healthcare, education, and employment opportunities, factors that can contribute to higher life expectancy compared to rural areas.

3.3 Estimation Techniques

To assess the relationship between the dependent and independent variables, this study employs both multiple regression analysis and first difference regression. Multiple regression analysis allows for the examination of the simultaneous effects of multiple independent variables on the dependent variable, thereby enabling a comprehensive assessment of the determinants of life expectancy. Additionally, first difference regression helps mitigate potential issues related to the omitted variable bias and unobserved heterogeneity by focusing on the changes in variables over time.

By employing robust quantitative methods and leveraging data from the World Development Indicators, this study seeks to provide valuable insights into the factors influencing life expectancy in developing countries. The utilization of multiple regression and first difference regression techniques allows for a rigorous examination of the relationships between economic, social, and demographic variables and life expectancy outcomes.

3.3.1 Multiple Linear Regression Analysis

Multiple regression analysis is a statistical technique used to examine the relationship between a dependent variable and two or more independent variables. It extends the basic concept of simple linear regression, which involves predicting a

dependent variable based on a single independent variable, to situations where multiple predictors influence the outcome of interest.

The regression equation represents the mathematical relationship between the dependent variable and the independent variables. In multiple regression, the equation takes the following form.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \varepsilon \tag{3.1}$$

where,

Y	= dependent variable
$X_1, X_2, \ldots, X_k$	= independent variables
β_0	= intercept (constant term)
$\beta_1, \beta_2, \ldots, \beta_k$	= the coefficients (regression coefficients) that represent the change in Y associated with a one-unit change in each independent variable, holding all other variables constant
ε	= the error term, representing the difference between the observed value of the dependent variable and the value predicted by the regression equation.

In multiple regression, the estimated regression equation takes the following form.

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2 + \ldots + \hat{\beta}_k X_k \tag{3.2}$$

where,

$\hat{Y}_i$	= the estimated value of the dependent variable
$\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \ldots + \hat{\beta}_k$	= the estimated values of the parameters $\beta_1, \beta_2, \ldots, \beta_k$

The process for estimating multiple linear regression models is very similar to that of simple regression. The method of ordinary least squares chooses the estimates to minimize the sum of squared residuals (Cohen & Cohen, 2003; Nayebi, 2020).

3.3.1.1 Interpreting the Multiple Linear Regression Equation

The regression coefficients (β) indicate the strength and direction of the relationship between each independent variable and the dependent variable. A positive coefficient suggests a positive relationship, meaning that an increase in the independent variable is associated with an increase in the dependent variable, while a negative coefficient suggests a negative relationship. The magnitude of the coefficient reflects the size of the effect of the independent variable on the dependent variable, holding all other variables constant.

The coefficient on X_1 measures the change in $\hat{Y}_i$ due to a one-unit increase in X_1, holding all other independent variables fixed. That is mean,

$$\Delta\hat{Y}_i = \hat{\beta}_1 \Delta X_1 \quad (3.3)$$

holding X_2, X_3, ..., X_k fixed. Thus, we have controlled for the variables X_2, X_3, ..., X_k when estimating the effect of X_1 on Y. The other coefficients have a similar interpretation.

3.3.1.2 Assumptions of the Multiple Linear Regression Model

There are a number of assumptions that should be assessed before performing a multiple regression analysis. The validity of the multiple regression model depends on all or some of the assumptions stated below.

Assumption 1: Linear in Parameters

This assumption implies that the relationship between the dependent variable and the independent variables is linear in the parameters.

Assumption 2: Random Sampling

The data should be collected through a process that ensures each sample point is independently and randomly selected. This ensures that the sample represents the population and that the results can be generalized.

Assumption 3: No Perfect Collinearity

There should be no perfect linear relationship between two or more of the independent variables. Perfect collinearity occurs when one independent variable is an exact linear combination of others, which makes it impossible to estimate the unique effect of each variable. In practical terms, multicollinearity (high, but not perfect collinearity) should be minimized.

Assumption 4: Zero Conditional Mean

The error term ϵ should have an expected value of zero given any value of the independent variables. Formally, $E(\epsilon|X) = 0$. This means that the independent variables do not contain any information about the errors.

Assumption 5: Homoscedasticity

The variance of the error term ϵ should be constant across all levels of the independent variables. This is called homoscedasticity. If the variance changes (heteroscedasticity), it can lead to inefficient estimates and affect hypothesis tests.

Assumption 6: Normality

The error terms should be normally distributed, especially important when the sample size is small. This assumption is crucial for the validity of hypothesis tests and confidence intervals. For larger sample sizes, the Central Limit Theorem ensures that the sampling distribution of the coefficients will be approximately normal even if the errors are not perfectly normal.

3.3.1.3 Testing Hypotheses for Overall Multiple Regression Model (F Test)

The overall F-test is used to test multiple hypotheses about the underlying parameters $\beta_1, \beta_2, \ldots, \beta_k$. It tests whether a set of independent variables has no partial effect on a dependent variable.

For testing the independent variables, the null hypothesis and alternative hypothesis state that

Null hypothesis $\quad H_0: \beta_1 = \beta_2 = \beta_3 = \ldots = \beta_k = 0$

Alternative hypothesis H_1: At least one $\beta_i \neq 0$ (3.4)

If the null hypothesis is not rejected, then there is no linear relationship between the Y variable and any of the independent variables. On the other hand, if the null is rejected, then at least one independent variable is linearly related to Y.

3.3.1.4 Coefficient of Determination (R^2)

The coefficient of determination can be calculated by using the errors sum of squares (SSE) and regression sum of square (SSR), and total sum of square (SST). The R^2 measures the variation in Y that is explained by the independent variable X in the simple linear regression model. In multiple regression, the coefficient of multiple determination represents the proportion of the variation in Y that is explained by the set of independent variables. The value of coefficient of multiple determination will be between zero and one. The R-squared is defined to be

$$R^2 = \frac{SSE}{SST} = 1 - \frac{SSR}{SST} \tag{3.5}$$

A common practice in multiple regression and correlation analysis is to report the adjusted coefficient of determination. Symbolized as $\bar{R}^2$, this statistic adjusts the measure of explanatory power for the number of degrees of freedom. The relationship between the coefficient of determination (R^2) and the adjusted coefficient of determination ($\bar{R}^2$) is expressed as

$$\bar{R}^2 = 1 - \left(\frac{n-1}{n-k-1}\right)(1 - R^2) \tag{3.6}$$

where,

n = number of observations

k = number of the explanatory variables

3.3.2 First Difference Regression

First difference regression, also known as differencing, is a statistical technique used to analyze panel data or time series data by taking the first difference of the

variables. It is particularly useful when dealing with data that exhibits trends or serial correlation over time. It is commonly used when dealing with time-series data to remove time-invariant unobservable variables. It involves taking the first difference of the variables and then regressing the differenced dependent variable on the differenced independent variables.

The first difference of a variable is calculated as the change in its value from one-time period to the next. Mathematically, the first difference of a variable Y at time t is computed as:

$$\Delta Y_t = Y_t - Y_{t-1} \tag{3.7}$$

where,

ΔY_t = first difference of Y at time t

Y_t = value of Y at time t

Y_{t-1} = value of Y at the previous time period (t-1)

Δ = first difference operator (i.e., the difference between the current value and the previous value) (Greene, 2003).

First difference regression eliminates time-invariant unobserved factors that may bias the estimates of the regression coefficients. This helps to control for omitted variable bias and other forms of unobserved heterogeneity.

It can help mitigate issues related to autocorrelation, which occurs when the error terms in a regression model are correlated over time. Differencing the data can help reduce the serial correlation in the residuals, making the regression results more reliable.

The coefficients estimated from first difference regression represent the marginal effect of changes in the independent variables on the dependent variable over time. This can provide valuable insights into the dynamic relationships between variables.

CHAPTER IV

RESULTS AND FINDINGS

This chapter presents the results of the study based on multiple regression analysis and first difference regression analysis.

4.1 Descriptive Statistics of Variables

The life expectancy of the developing countries in 2008 and 2018 is described in the appendix section. In 2008, the developing countries with the lowest life expectancy (<45 years) are Eswatini (44.175) and Lesotho (43.566). The developing countries with the highest life expectancy (>77 years) are Albania (77.653), Costa Rica (78.445), Cuba (77.429), and Lebanon (77.584). In 2018, the developing countries with the lowest life expectancy (<55 years) are the Central African Republic (54.369), Chad (52.825), Lesotho (53.733), and Nigeria (52.554). The developing countries with the highest life expectancy (>79 years) are Albania (79.184), Costa Rica (79.484), Lebanon (79.729), and the Maldives (80.013).

The descriptive statistics of the mean, standard deviation, minimum value, and maximum value of the variables utilized in this study are shown in Table 4.1.

Table 4.1 Summary statistics of key variables

		2008				2018			
Variable	Obs	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
lfe	119	65.4	8.2	43.6	78.4	69.0	6.5	52.6	80.0
gdpc	119	3472.9	3096.5	300.8	14487.7	4242.3	3723.5	274.1	17818.2
sani	119	59.4	29.8	5.2	98.7	67.1	28.5	8.3	99.0
fert	119	3.6	1.6	1.3	7.5	3.1	1.3	1.3	7.0
urban	119	47.1	19.9	10.1	100.0	51.1	20.4	13.0	100.0

Source: Own calculations.

The mean value of life expectancy at birth (years) is 65.4 with a standard deviation of 8.2 in 2008, whereas the mean value is 69.0 with a standard deviation of 6.5 in 2018. This indicates an increase in life expectancy of approximately 3.6 years over a ten-year period. The minimum and maximum values are 43.6 and 78.4 in 2008, and 52.6 and 80.0 in 2018, respectively.

The mean value of GDP per capita is 3472.9 with a standard deviation of 3096.5 in 2018, rising to 4242.3 with a standard deviation of 3723.5 in 2018. This signifies an increase in GDP per capita of about 769.4 over the decade. The minimum and maximum values are 300.8 and 14487.7 in 2008, and 274.1 and 17818.2 in 2018, respectively.

Regarding people using at least basic sanitation services, the mean value in 2008 is 59.4 with a standard deviation of 29.8, increasing to 67.1 with a standard deviation of 28.5 in 2018. This represents a sanitation improvement of approximately 7.7 over the ten-year span. The minimum and maximum values are 5.2 and 98.7 in 2008, and 8.3 and 99.0 in 2018, respectively.

The mean value of fertility rate in 2008 is 3.6 with a standard deviation of 1.6, which decreases slightly to 3.1 with a standard deviation of 1.3 in 2018. This indicates a marginal decrease in fertility of about 0.5 over the decade. The minimum and maximum values are 1.3 and 7.5 in 2008, and 1.3 and 7.0 in 2018 respectively.

Lastly, the mean value of urban population in 2008 is 47.1 with a standard deviation of 19.9, decreasing to 51.1 with a standard deviation of 20.4 in 2018. This suggests a decrease in urban population of approximately 4 over the ten-year period. The minimum and maximum values are 10.1 and 100.0 in 2008, respectively, and 13.0 and 100.0 in 2018.

4.2 Multiple Regression Analysis and First Difference Regression Analysis for Life Expectancy at Birth

The estimation results from OLS and first difference estimation methods are described in Table 4.2. According to estimation results, the estimated life expectancy of the developing country for 2008 and 2018 will be:

For 2008: $lfe = 63.36 + 0.0002gdpc + 0.12sani - 1.81fert + 0.02urban$

For 2018: $lfe = 67.16 + 0.0003gdpc + 0.09sani - 1.89fert + 0.01urban$

According to the result of 2008 data using OLS method, GDP per capita is 0.0002, basic sanitation services is 0.12, fertility rate is -1.81, Urban population is 0.02. According to the results, the basic sanitation services and fertility rate are the factors significantly influencing the life expectancy at birth at 1% level. The coefficient of

sanitation (0.12) indicates that the life expectancy at birth will increase 0.12 year, if the sanitation increases by 1% after adjusting for all other variables (*gdpc*, *fert* and *urban*) in the model. On the other hand, the coefficient of fertilization (-1.81) indicates that the life expectancy at birth will be less than 1.81 year, if the fertilization increases by 1% after adjusting for all other variables (*gdpc*, *sani* and *urban*) in the model.

Table 4.2 Estimation results of OLS (2008), OLS (2018) and their first difference

Variables	OLS (2008)	OLS (2018)	First Difference
gdpc	0.0002	0.0003***	
	(0.0002)	(0.0001)	
sani	0.12***	0.09***	
	(0.02)	(0.02)	
fert	-1.81***	-1.89***	
	(0.47)	(0.42)	
urban	0.02	0.01	
	(0.03)	(0.02)	
D.gdpc			0.0005**
			(0.0002)
D.sani			0.09**
			(0.04)
D.fert			-2.52***
			(0.68)
D.urban			0.18**
			(0.08)
Constant	63.36***	67.16***	
	(3.63)	(2.58)	
Observations	119	119	119
R^2	0.657	0.754	0.533
Adjusted $\bar{R}^2$	0.645	0.745	0.512
F value	54.485	87.204	32.852

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

According to the results of the 2018 data using the OLS method, the coefficients are as follows: GDP per capita is 0.0003, basic sanitation services is 0.09, fertility rate is -1.89, and urban population is 0.01. The results show that the *gdpc*, *sani* and *fert* are the factors significantly influencing the life expectancy at birth at 1% level. The coefficient of sanitation (0.09) indicates that the life expectancy at birth will increase

0.09 year if the sanitation increases by 1% after adjusting for all other variables (*gdpc*, *fert* and *urban*) in the model. On the other hand, the coefficient of fertilization (-1.89) indicates that the life expectancy at birth will be less than 1.89 year if the fertilization increases by 1% after adjusting for all other variables (*gdpc*, *sani* and *urban*) in the model.

In multiple regression, the R^2 measures the correlation between the observed values of the dependent variable and the predicted values based on the regression model. According to the result of 2008 data, the R^2 value of 0.657 indicates that all the independent variables (*gdpc, sani, fert* and *urban*) together in the model explains 65.7% variation in the life expectancy at birth. According to the result of 2018 data, the R^2 value of 0.754 indicates that all the independent variables (*gdpc, sani*, *fert* and *urban*) together in the model explains 75.4% variation in the life expectancy at birth.

The adjusted $\bar{R}^2$ values suggest strong explanatory power for both OLS models, with the 2018 model showing improved explanatory power compared to 2008. The first difference model also demonstrates a moderate fit. All F values are significant, indicating that the overall regression models are statistically significant and that the independent variables collectively have a significant impact on life expectancy in both the OLS and first difference models.

Overall, the first difference regression analysis indicates that improvements in basic sanitation services, reductions in fertility rates, urbanization, and changes in GDP per capita have all played significant roles in driving increases in life expectancy in developing countries over time. These findings underscore the importance of targeted interventions and policies aimed at improving public health infrastructure, promoting family planning initiatives, and fostering sustainable economic growth to further enhance life expectancy outcomes in these regions.

CHAPTER V

CONCLUSION

The study investigates the determinants of life expectancy in 119 developing countries using panel data for the years 2008 and 2018. This chapter presents a discussion of the findings regarding the relationship between life expectancy and key socio-economic indicators, recommendations for policy, and suggestions for possible further research.

5.1 Discussion on Findings

Efforts to conduct cross-national analyses on life expectancy face several challenges. Firstly, international comparisons are hindered by difficulties in obtaining and ensuring the reliability of relevant data. Secondly, there is a risk that a significant variable included in the analysis might represent not only itself but also other highly correlated factors. Thirdly, inferring likely changes in life expectancy for specific countries based on cross-sectional results carries inherent risks. Lastly, the presence of specification bias in the model can lead to inaccurate estimates. It is crucial to bear these issues in mind when interpreting the results. However, despite these challenges, the analysis presented provides valuable insights into policies aimed at prolonging life expectancies.

The expansion of life expectancy is a focal point of medical and socioeconomic research, serving as a critical indicator of overall population health and well-being. It reflects not only the health of a country's people but also the quality of healthcare received during illness. Understanding the determinants of life expectancy in developing countries is pivotal for policymakers to formulate effective strategies aimed at improving public health outcomes.

In this study, the relationship between life expectancy and key socio-economic factors across 119 developing countries is investigated utilizing data from the World Development Indicators. Through multiple regression analysis and first difference regression, we assessed the impact of various socio-economic and demographic factors on life expectancy.

The descriptive statistics provide valuable insights into the socio-economic and health improvements in developing countries between 2008 and 2018. The increase in

mean life expectancy from 65.4 years in 2008 to 69.0 years in 2018 reflects a significant enhancement in overall health outcomes. Notably, Eswatini and Lesotho had the lowest life expectancies in 2008, whereas by 2018, countries like the Central African Republic and Chad joined Lesotho with life expectancies below 55 years. On the other hand, countries like Albania, Costa Rica, and Lebanon consistently maintained high life expectancies, exceeding 77 years in 2008 and reaching over 79 years by 2018. GDP per capita also saw a notable rise from an average of 3472.9 in 2008 to 4242.3 in 2018, indicating economic growth. Basic sanitation services improved, with mean access increasing from 59.4% to 67.1%, showcasing efforts towards better public health infrastructure. The fertility rate showed a slight decline from an average of 3.6 to 3.1, aligning with global trends of decreasing fertility rates as economies develop and healthcare improves. Urban population percentages also saw a modest increase, highlighting ongoing urbanization trends in these regions. Overall, these statistics underscore significant progress in health, economic, and infrastructure domains, despite persistent challenges in specific countries.

Multiple regression analysis identified basic sanitation services and fertility rate as significant factors influencing life expectancy at birth in 2008, while in 2018, GDP per capita, basic sanitation services, and fertility rate emerged as significant determinants. The analysis demonstrated an inverse relationship between fertility rate and life expectancy, indicating that lower fertility rates are associated with higher life expectancy. Furthermore, first difference regression analysis indicated that GDP per capita, basic sanitation services, fertility rate, and urban population significantly influenced life expectancy at birth.

Recognizing the multifaceted and interconnected determinants of life expectancy, policymakers, public health officials, and stakeholders must collaborate to implement comprehensive strategies addressing root causes of poor health outcomes and promoting well-being in developing countries. Enhancing life expectancies in these nations could be substantially achieved through changes in GDP per capita, basic sanitation services, fertility rates, and urban population. While this study provides valuable insights into factors influencing life expectancy trends in developing countries, it is important to acknowledge other significant factors such as healthcare infrastructure, education, and environmental conditions, which are beyond its scope.

Additionally, limitations inherent to the data, such as measurement errors and missing values, may impact the robustness of findings.

5.2 Recommendations

To enhance life expectancy in developing countries, policymakers should focus on the following:

(i) Improving Basic Sanitation Services: Ensuring access to clean water and adequate sanitation facilities to reduce the prevalence of waterborne diseases and improve overall hygiene.

(ii) Promoting Sustainable Economic Growth: Implementing policies that foster economic development to increase GDP per capita, thereby improving access to healthcare and other essential services.

(iii) Managing Fertility Rates: Promoting family planning and reproductive health education to manage fertility rates, which can improve maternal and child health outcomes.

(iv) Ensuring Sustainable Urbanization: Developing infrastructure to support urbanization, ensuring access to healthcare, education, and employment opportunities in urban areas.

Reliable data collection is crucial for informed decision-making, and collaborative efforts among governments, international organizations, and local communities are essential for comprehensive health strategies. Addressing these key determinants, alongside other factors like healthcare infrastructure and education, can significantly improve public health outcomes and life expectancy.

5.3 Further Study

For further study, researchers should explore the impact of additional variables such as healthcare infrastructure, education levels, and environmental conditions on life expectancy in developing countries. Longitudinal studies could provide more insights into how these factors evolve over time and interact with each other. Additionally, examining the role of policy interventions and their effectiveness in different socio-economic contexts would be valuable. Further research could also address limitations related to data accuracy and availability by employing advanced statistical techniques to handle missing values and measurement errors. Expanding the scope to include

qualitative analyses and case studies could offer a more nuanced understanding of the local factors influencing life expectancy. In particular, employing Fixed Effects and Random Effects models could be beneficial for accounting for unobserved heterogeneity and distinguishing between within-country and between-country variations in the determinants of life expectancy. Fixed Effects models would control for time-invariant characteristics of the countries, while Random Effects models could provide more efficient estimates when the assumption of no correlation between the unobserved effects and the explanatory variables holds. Researchers might also consider using data from international organizations such as the World Health Organization (WHO) and the World Bank, which provide comprehensive datasets on health and socio-economic indicators. Incorporating spatial analysis techniques, such as Geographic Information Systems (GIS), spatial regression models, and hot spot analysis, could help identify regional patterns and disparities. Finally, integrating behavioral and cultural factors into the analysis could provide deeper insights into the complex dynamics affecting life expectancy in these regions.

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APPENDIX

List of developing countries

Country Name	Life Expectancy (Years) 2008	Life Expectancy (Years) 2018
Afghanistan	59.852	63.081
Albania	77.653	79.184
Algeria	72.941	76.066
Angola	54.633	62.144
Armenia	72.398	75.064
Bangladesh	67.051	72.567
Belarus	70.4561	74.17561
Belize	71.151	73.703
Benin	57.869	60.14
Bhutan	67.499	71.129
Bolivia	65.446	67.748
Botswana	57.121	65.422
Brazil	72.715	75.109
Burkina Faso	55.342	60.047
Burundi	55.71	61.688
Cabo Verde	72.508	75.733
Cambodia	66.47	70.561
Cameroon	55.655	61.18
Central African Republic	48.016	54.369
Chad	49.024	52.825
China	74.872	77.744
Colombia	74.295	76.748
Congo, Dem. Rep.	55.339	59.942
Congo, Rep.	60.426	64.053
Costa Rica	78.445	79.484
Cote d'Ivoire	53.653	58.849
Cuba	77.429	77.496
Dominican Republic	71.658	73.232
Ecuador	74.983	77.094

Egypt, Arab Rep.	69.319	71.367
El Salvador	71.424	72.555
Eswatini	44.175	59.411
Ethiopia	57.592	65.412
Fiji	66.935	67.81
Gabon	63.083	66.306
Gambia, The	60.082	63.04
Georgia	71.332	73.341
Ghana	60.49	64.122
Guatemala	70.356	72.726
Guinea	56.044	59.349
Guinea-Bissau	54.646	60.502
Guyana	66.288	68.896
Haiti	61.332	64.019
Honduras	70.441	72.814
Hungary	73.70244	76.06585
India	66.149	70.71
Indonesia	68.226	70.338
Iran, Islamic Rep.	72.624	76.195
Iraq	64.942	71.514
Jamaica	71.612	71.793
Jordan	73.591	75.774
Kazakhstan	67.11	73.15
Kenya	59.614	62.676
Kiribati	64.834	66.855
Kyrgyz Republic	68.45122	71.4
Lao PDR	62.603	67.634
Lebanon	77.584	79.729
Lesotho	43.566	53.733
Libya	72.269	72.794
Liberia	58.772	60.853
Madagascar	62.142	65.27
Malawi	54.604	63.276

Malaysia	74.25	75.644
Maldives	76.543	80.013
Mali	55.291	59.393
Marshall Islands	63.236	64.5
Mauritania	62.399	65.31
Mexico	74.152	74.015
Moldova	69.394	70.492
Mongolia	66.382	71.199
Montenegro	75.13659	76.84146
Morocco	70.048	73.986
Mozambique	53.164	60.526
Myanmar	56.506	66.465
Namibia	54.653	62.586
Nauru	58.833	63.234
Nepal	66.421	68.979
Niger	56.508	62.454
Nigeria	50.225	52.554
Pakistan	64.036	66.482
Panama	76.225	77.863
Papua New Guinea	62.571	65.182
Paraguay	71.384	73.568
Peru	73.377	76.009
Philippines	70.564	71.689
Romania	72.56585	75.35854
Poland	75.5439	77.60244
Rwanda	61.134	66.251
Samoa	72.155	72.636
Sao Tome and Principe	65.079	68.355
Senegal	63.242	68.097
Serbia	73.88537	75.89024
Sierra Leone	51.526	59.796
Slovak Republic	74.70488	77.26585
Solomon Islands	68.404	70.173

South Africa	56.022	65.674
Sri Lanka	71.729	75.748
St. Lucia	72.698	73.357
Suriname	68.816	72.553
Syrian Arab Republic	73.551	70.145
Tajikistan	67.688	70.353
Tanzania	58.086	66.535
Thailand	75.492	78.662
Timor-Leste	64.329	68.017
Togo	56.695	60.244
Tonga	70.164	70.779
Tunisia	75.185	75.95
Turkiye	74.45	77.563
Turkmenistan	67.407	68.796
Tuvalu	63.948	64.212
Uganda	55.823	62.714
Ukraine	68.25146	71.58268
Uzbekistan	68.765	71.149
Vanuatu	69.602	69.795
Viet Nam	73.411	73.976
West Bank and Gaza	72.413	74.793
Yemen, Rep.	66.963	64.575
Zambia	53.945	62.342
Zimbabwe	46.723	61.414